Ash Creek Associates
Environmental and Geotechnical Consultants

MEMORANDUM

Date: April 18, 2013

To: Kelly Madalinski, Port

From: Michael Pickering

Re: Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon
1267-12

This letter represents the results of the Source Control Measures (SCMs) and storm water sampling conducted at the Terminal 4 Slip 1 Upland Facility (the Facility) located in Portland, Oregon (Figures 1 through 4). These activities were completed in accordance with the Oregon Department of Environmental Quality (DEQ)-approved *Additional Storm Water Sampling Work Plan* (the Work Plan; Ash Creek, 2012) and the *Response to DEQ Comments* letter (Port of Portland [Port], 2012).

SAMPLING ACTIVITIES

Preparatory Activities

The following activities were completed in preparation for the field work.

- Health and Safety Plan (HASP). Apex Companies prepared a HASP for its personnel involved with the project.
- Work in Tenant Areas. The work activities were conducted in coordination with tenant schedules.

Source Control Measures

The Basin M treatment system was modified per the following (Figures 5 and 6).

- ConTech's ZPG™ (zeolite, perlite, and GAC) StormFilter media was installed in place of the CSF® Leaf Media that was historically used.
- The height of the diversion wall in the conveyance line (on the bypass around the treatment system) was increased to direct a greater volume of water to the treatment system.

Storm Water Sampling

The sampling activities were completed consistent with the methods and procedures presented in the above-referenced documents.

Sampling Event Criteria

The following storm event criteria were consistent with the JSCS guidance document (DEQ/EPA, 2005). The storm event criteria are as follows:

1) Each sampling event is preceded by an antecedent dry period of at least 24 hours (as defined by less than 0.1 inch of precipitation over the previous 24 hours);
2) Minimum predicted rainfall volume of greater than 0.2 inch per event; and
3) Expected storm event duration of at least 3 hours.

The rain gauge at Terminal 4 (maintained by the City of Portland Hydra Network) was abandoned in the summer of 2011. A rain gauge at Swan Island (maintained by the City of Portland Hydra Network) was used to confirm that the sampling criteria were met. The rain gauge lists the rainfall depth per hour (reported on a one- to three-hour time delay). The rain gauge data are found at the following internet address: http://or.water.usgs.gov/non-usgs/bes/swan_island_pump.rain

Storm Water Sampling Procedures

Flow-weighted composite samples were collected from Basin L and Basin M using the same manholes where sampling was historically conducted (Figure 7).

Storm Events

A storm water sample was collected from Basin M on November 11, 2012. The composite sampler installed in Basin L malfunctioned during this event and no sample was collected. A storm water sample was collected from Basin L on November 17, 2012. Storm water samples were collected from both basins on February 22, 2013. Storm water hyetographs that present the 24-hour antecedent dry period, rainfall intensity, rainfall duration, and sample times are included in Attachment A.

LABORATORY ANALYSIS

The samples collected from the above activities were submitted to ALS Environmental in Kelso, Washington for chemical analysis. Copies of the laboratory reports are included in Attachment B (in CD-Rom format due to the length of the Level III deliverable report) along with a data quality review. The samples were analyzed on a standard turnaround time.

The storm water samples were analyzed for the following analyses:

- Total Suspended Solids (TSS) by SM 2540D;
- Total metals (aluminum, antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc) by EPA Method 200.8;
- Total arsenic by EPA Method 1632;
- Total mercury by EPA Method 7470A;
- Total polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270-SIM; and
- Total polychlorinated biphenyls (PCBs) as Aroclors by EPA Method 8082.

Method reporting limits (MRLs) consistent with those presented in the Work Plan were requested from the analytical laboratory.

ANALYTICAL RESULTS

Tables 1 through 4 present the analytical data from the recent storm water sampling events together with historical sample results.

PATH FORWARD

The Port is currently evaluating the results for Basin L and Basin M and will be communicating to DEQ next steps within the next 30 days.

REFERENCES

Ash Creek, 2012. Additional Storm Water Sampling Work Plan, Terminal 4 Slip 1 Upland Facility. Prepared for the Port of Portland, August 1, 2012.

Port, 2012. Response to DEQ Comments, Additional Storm Water Sampling Work Plan, Port of Portland Terminal 4 Slip 1. September 21, 2012.

ATTACHMENTS

Table 1 – Storm Water Analytical Results: Metals
Table 2 – Storm Water Analytical Results: Polychlorinated Biphenyl Aroclors
Table 3 – Storm Water Analytical Results: Polycyclic Aromatic Hydrocarbons
Table 4 – Storm Water Analytical Results: General Chemistry Parameters

Figure 1 – Facility Location Map
Figure 2 – Facility Plan
Figure 3 – Leasehold Boundary Plan
Figure 4 – Storm Drain System and Drainage Basins
Figure 5 – Storm Water Controls
Figure 6 – Basin M Stormfilter® Treatment System
Figure 7 –Storm Water Sampling Locations

Attachment A – Storm Water Hyetographs
Attachment B – Laboratory Analytical Reports (CD-ROM) and Data Quality Review

Table 1
Storm Water Analytical Results: Metals
Terminal 4
Portland, Oregon

Monitoring Location	Date Sampled	TSS	Aluminum		Antimony		Arsenic		Cadmium		Chromium		Copper		Lead		Mercury		Nickel		Selenium		Silver		Zinc	
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
		(mg/L)	Concentrations in µg/L (ppb)																							
Basin L	3/24/2007	108	1,540	102	0.9	0.59	0.803	0.898	0.42	< 0.02	5.41	1.73	15.1	4.98	31	0.111	0.02 B	< 0.02	3.69	0.25	0.2 B	< 0.02	0.062 J2	0.003 B	237	3.2
Basin L	5/3/2007	207	1,850	168	0.83	0.975	<0.5	0.22 B	0.576	0.036 B	7.81	2.86	23.3	6.96	43	0.36	0.04 B J3	0.04 B J3	5.07	<1.0	<5.0	<5.0	0.072 B	<0.1	457 J2	11.5
Basin L	5/20/2007	309	4,090	77.4	1.39	1.04	1.64	2.38	1.81	0.336	13	1.88	35.7	8.37 J4	50.3 N	0.328 N J4	0.2	0.05 B	10.4	0.75	<1.0	<1.0	0.401	0.034	633	9.25
Basin L	9/28/2007	80	3,060	160	1.2	0.82	1.07	1.34	0.968	0.036	6.41	1.84	25.6	9.83	47.4	0.447	0.04 B	<1.0	5.74	0.96	<1.0	<1.0	0.107	0.013 B	382	9.58
Basin L	10/23/2010	7	956	330 R	12.7	11.5 R	5.0	5.7 R	0.23	0.14 R	<0.24 J7	1.6 R	21.6	18.6 R	19.5	7.2 R	<0.011	<0.011 R	3.5	2.3 R	0.23 B	0.23 B R	0.079 B J3 J7	0.52 R	137	49.4 R
Basin L	11/6/2010	28	549	268 R	13.1	12.2 R	3.7	3.8 R	0.15	0.093 R	3.5	3 R	16.1	11.9 R	2.2	4.1 R	<0.011	<0.011 R	2.0	1.4 R	0.16 B J7	0.20 B R	0.11 B J3	1.1 R	105 J7	43.9 R
Basin L	2/12/2011	10	594	128	0.73	0.40 B	0.95	0.91	0.14	0.022 B	1.7	0.8	6.1	3.9	6.3	0.46	<0.011	<0.011	1.5	0.39 B	0.18 B	0.11 B J3	0.22 B J3	<0.071	122	14.7
Basin L	11/17/2012	73.6	972	--	0.599	--	0.354	--	0.340	--	3.79	--	9.79	--	19.6	--	<0.02	--	2.85	--	0.4 J	--	0.03	--	221	--
Basin L	2/22/2013	114	1,400	--	0.659	--	0.391	--	0.498	--	5.21	--	13.8	--	26.1	--	<0.02	--	3.99	--	<0.3	--	0.05	--	281	--
Basin M	3/24/2007	117	5,060	28.6	1.27	0.94	3.67	3.0	0.79	< 0.02	9.16	1.24	32.5	7.45	104	0.35	0.09 B	< 0.02	8.46	0.99	0.6 B	< 0.02	0.252 J2	0.013 B	172	1.3
Basin M	5/3/2007	66	2,050	24.8	1.5	1.32	3.27 J2	3.16	0.36	0.122	6.56	2.3	31	18.1	36.1	0.984	0.05 B J3	0.04 B J3	5.91	2.53	<1.0	<1.0	0.148	0.032	90.5 J2	11.1
Basin M	5/20/2007	--	2,410	22.1	1.23	1.18	3.39	2.95	0.434	0.152	5.82	1.88	24.3	17.3	26.4 N	0.871 N	<0.2	<0.2	6.18	3.3	0.8 B	<0.2	0.155	0.035	79.9	10.6
Basin M	9/28/2007	39	1,750	11.5	0.92	0.71	2.32	2.03	0.262	0.057	2.91	0.76	15.5	9.42	26.3	0.281	0.03 B	0.04 B	3.06	1.27	<1.0	<1.0	0.065	0.009 B	78.6	15
Basin M	10/23/2010	4	1,790	452 R	2.4	2.3 R	15.8	14.8 R	0.20	0.15 R	<0.24	<0.24 R	25.6	19.7 R	32.3	11.8 R	<0.011	<0.011 R	4.0	2.4 R	0.70	0.74 R	0.092 B J3	0.35 B R	42.0	23.8 R
Basin M	11/6/2010	<1	2,110	1,700 R	1.6	1.8 R	6.9	7.1 R	0.24	0.17 R	4.1	3.0 R	20.7	18.7 R	3.6	8.9 R	<0.011	<0.011 R	3.9	2.8 R	0.46 B	0.43 B R	<0.071	0.55 R	49.0	46.9 R
Basin M	2/12/2011	9	3,130	93	0.89	0.38 B	3.3	1.3	0.30	<0.020	6.4	0.61	20.5	5.4	25.0	0.74	<0.011	<0.011	4.5	0.49 B	0.25 B	<0.10	<0.071	<0.071	116	9.4
Basin M	11/11/2012	13.5	572	--	0.49	--	0.956	--	0.082	--	1.72	--	7.75	--	9.0	--	<0.02	--	1.04	--	<0.3	--	0.039	--	30.3	--
Basin M	2/22/2013	75.5	1,510	--	0.491	--	0.545	--	0.270	--	3.29	--	15.7	--	32.8	--	<0.02	--	2.48	--	<0.3	--	0.075	--	76.6	--
Applicable JSCS Screening Level Value			50-200	50-200	6.0	6.0	0.045	0.045	--	0.094	100	100	--	2.7	--	0.54	--	0.77	--	16	--	5.0	0.12	--	--	36

Notes:
1. Metals analysis by EPA Method 6020 or EPA Method 200.8. Arsenic by EPA Method 6020 or EPA Method 1632.
2. Mercury analysis by EPA Method 7470A.
3. µg/L (ppb) = Micrograms per liter (parts per billion).
4. Screening levels used taken from Portland Harbor Joint Source Control Strategy Table 3-1: Screening Level values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water (7/16/07 Revision).
5. **Bolded** values indicates concentration exceeds applicable screening level value.
6. B = This result is an estimated concentration that is less than the Method Reporting Limit (MRL) and greater than the Method Detection Limit (MDL).
7. J2 = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. The precision goal of 30% was exceeded for this analyte by the results from the field duplicate or the lab duplicate.
8. J3 = The detected concentration of this analyte is equal to or less than 5 times the concentration detected in the method blank.
9. J4 = The detected concentration of this analyte is equal to or less than 5 times the concentration detected in the filter blank.
10. J7 = The matrix spike recovery for this analyte exceeded the control criteria.
11. N = The Matrix Spike sample recovery is not within control limits.
12. R = The data are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria.
13. Shading indicates that the data have been rejected.
14. Filtration methods used for the dissolved analyses of samples collected on October 23, 2010 and November 6, 2010 were incorrect. The filter used was larger than specified in LWG protocols and the dissolved concentrations are likely biased high
15. mg/L = milligrams per liter
16 TSS = total suspended solids by by EPA Method 160.2 or SM 2540D.

Table 2
Storm Water Analytical Results: Polychlorinated Biphenyl Aroclors
Terminal 4
Portland, Oregon

Monitoring Location	Date Sampled	TSS	Aroclor 1016		Aroclor 1221		Aroclor 1232		Aroclor 1242		Aroclor 1248		Aroclor 1254		Aroclor 1260		Aroclor 1262		Aroclor 1268	
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
		(mg/L)	Concentrations in µg/L (ppb)																	
Basin L	3/24/2007	108	<0.0048	<0.0048	<0.0096	<0.0096	<0.0048	<0.0048	0.039	0.021 P	<0.0048	<0.0048	0.043	0.039	0.038	0.029	<0.0048	<0.0048	<0.0048	<0.0048
Basin L	5/3/2007	207	<0.0059	<0.0059	<0.012	<0.012	<0.0059	<0.0059	0.03	0.02	<0.0059	<0.0059	0.045	0.034 P	0.039	0.028	<0.0059	<0.0059	0.0044 J P	<0.0059
Basin L	5/20/2007	309	<0.0052	<0.0050	<0.011	<0.010	<0.0052	<0.0050	0.094	0.036 P	<0.0052	<0.0050	0.063	0.015	0.036	0.011	<0.0052	<0.0050	<0.0052	<0.0050
Basin L	9/28/2007	80	<0.039 i	--	<0.047 i	--	<0.046 i	--	<0.055 i	--	<0.039 i	--	<0.036 i	--	<0.020 i	--	<0.019 i	--	<0.030 i	--
Basin L	10/23/2010	7	<0.010	<0.010 R	<0.010	<0.035 Y R	<0.010	<0.010 R	<0.010	<0.010 R	<0.012 Y	<0.010 R	<0.010	<0.010 R	0.020 P	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R
Basin L	11/6/2010	28	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R
Basin L	2/12/2011	10	<0.010	--	<0.010	--	<0.020 Y	--	<0.010	--	<0.010	--	<0.010	--	<0.010	--	<0.010	--	<0.010	--
Basin L	11/17/2012	73.6	<0.0021	--	<0.0021	--	<0.0021	--	0.03	--	<0.0021	--	0.037	--	0.023	--	<0.0021	--	<0.0021	--
Basin L	2/22/2013	114	<0.0021	--	<0.0021	--	<0.0021	--	0.028	--	<0.0021	--	0.034	--	0.028	--	<0.0021	--	<0.0021	--
Basin M	3/24/2007	117	<0.0049	<0.0050	<0.0097	<0.010	<0.0049	<0.0050	<0.0049	<0.0050	<0.0049	<0.0050	0.041	0.043	0.048	0.049	<0.0049	<0.0050	<0.0049	<0.0050
Basin M	4/7/2007	35	<0.0049	<0.0048	<0.0097	<0.0096	<0.0049	<0.0048	<0.0049	<0.0048	<0.0049	<0.0048	0.021 J2	0.019	0.024	0.024	<0.0049	<0.0048	<0.0049	<0.0048
Basin M	5/3/2007	66	<0.0048	<0.0048	<0.0096	<0.0096	<0.0048	<0.0048	<0.0048	<0.0048 i	<0.0048	<0.0048	0.027	0.022	0.031	0.026	<0.0048	<0.0048	<0.0048	<0.0048
Basin M - Dup	5/3/2007	66	<0.0048	<0.0048	<0.0096	<0.0096	<0.0048	<0.0048	0.018 P	<0.0064 i	<0.0048	<0.0048	0.027	0.025	0.033	0.027	<0.0048	<0.0048	0.0098 P	<0.0048
Basin M	9/28/2007	39	<0.015 i	--	<0.013 i	--	<0.012 i	--	<0.010 i	--	<0.017 i	--	<0.021 i	--	<0.014 i	--	<0.0097 i	--	<0.0081 i	--
Basin M	10/23/2010	4	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	0.026 P	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R
Basin M	11/6/2010	<1	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R	0.012	<0.010 R	<0.010	<0.010 R	<0.010	<0.010 R
Basin M	2/12/2011	9	<0.010	--	<0.010	--	<0.010	--	<0.010	--	<0.010	--	0.012	--	0.021	--	<0.010	--	<0.010	--
Basin M	11/11/2012	13.5	<0.0023	--	<0.0023	--	<0.0023	--	<0.0023	--	<0.0023	--	<0.0023	--	0.0084	--	<0.0023	--	<0.0023	--
Basin M	2/22/2013	75.5	<0.011	--	<0.0065	--	<0.020	--	<0.017	--	<0.011	--	0.017	--	0.027	--	<0.0022	--	<0.0022	--
Applicable JSCS Screening Level Value		NA	0.96	0.96	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.033	0.033	0.034	0.034	NA	NA	NA	NA

Notes:
1. PCB Aroclors by EPA Method 8082.
2. µg/L (ppb) = Micrograms per liter (parts per billion).
3. Screening levels used taken from Portland Harbor Joint Source Control Strategy Table 3-1: Screening Level values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water (7/16/07 Revision).
4. **Bolded** values indicates concentration exceeds applicable screening level value
5. P = The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
6. J = The result is an estimated concentration that is below the Method Reporting Limit (MRL) and above the Method Detection Limit (MDL)
7. i = The Method Reporting Limit (MRL) / Method Detection Limit (MDL) has been increased due to chromatographic interference.
8. J2 = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. The precision goal of 30% was exceeded for this analyte by the results from the primary and field duplicate sample or the lab duplicate
9. R = The data are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria.
10. Shading indicates that the data have been rejected.
11. -- = Not sampled or not available.
12. Y = The analyte is not detected at or above the reported concentration. Thereporting limit is raised due to chromatographic interference. The Y flag isequivalent to the U flag with a raised reporting limit.
13. Filtration methods used for the dissolved analyses of samples collected on October 23, 2010 and November 6, 2010 were incorrect. The filter used was larger than specified in LWG protocols and the dissolved concentrations are likely biased high
14. mg/L = milligrams per liter
15. TSS = total suspended solids by by EPA Method 160.2 or SM 2540D.

Table 3
Storm Water Analytical Results: Polycyclic Aromatic Hydrocarbons
Terminal 4
Portland, Oregon

Monitoring Location	Date Sampled	TSS	Naphthalene		2-Methylnaphthalene		Acenaphthylene		Acenaphthene		Dibenzofuran		Fluorene		Phenanthrene		Anthracene		Fluoranthene	
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
		(mg/L)	Concentrations in µg/L (ppb)																	
Basin L	3/24/2007	108	0.14	0.056	0.27	0.088	0.032	0.021	0.200	0.013 J	--	--	0.15	0.018 J	1.4	0.055	0.20	0.017 J	3.0	0.097
Basin L	5/3/2007	207	0.11	0.10	0.16	0.16	0.029	0.022 J3	0.18	0.13	0.11	0.09	0.16	0.13	1.6	1.3	0.18	0.11	2.8	2.0
Basin L	5/20/2007	309	0.085	0.032	0.039	0.015 J	0.013 J	0.0073 J	0.28	0.057	0.087	0.03	0.12	0.032	1.9	0.63	0.26	0.065	4.6	1.3
Basin L	9/28/2007	80	0.058	--	0.024	--	0.0088 J	--	0.062	--	--	--	0.034	--	0.73	--	0.062	--	1.5	--
Basin L	10/23/2010	7	0.029	0.031 R	0.018	0.015 R	0.027	0.029 R	0.025	0.013 J R	--	--	0.035	0.025 R	0.28	0.022 R	0.18	0.18 R	0.54	0.030 R
Basin L	11/6/2010	28	0.023 J3	0.019 J3 R	0.019	0.013 J R	0.0058 J	0.015 R	0.016	0.011 J R	--	--	0.016	0.010 J R	0.12	0.03 R	0.05	0.06 R	0.19	0.026 R
Basin L	2/12/2011	10	0.046 J3	0.018 J3 R	0.037 J3	0.014 J3 R	0.0051 J J3	0.0020 J J3 R	0.019	0.010 J R	--	--	0.022 J3	0.011 J J3 R	0.29	0.046 J3 R	0.025	0.015 R	0.42	0.02 J3 R
Basin L	11/17/2012	73.6	0.058	--	0.024	--	0.0079	--	0.057	--	0.027	--	0.028	--	0.45	--	0.057	--	0.73	--
Basin L	2/22/2013	114	0.033		0.026		0.018		0.070		0.030		0.036		0.74		0.096		1.3	
Basin M	3/24/2007	117	0.059	0.031 J3	0.069	0.024	0.084	0.054	0.22	0.067	--	--	0.12	0.038	0.35	0.10	0.19	0.072	1.4	0.53
Basin M	4/7/2007	35	0.018 J	0.017 J	0.019 J	0.017 J	0.035	0.058	0.032	0.028	--	--	0.025	0.026	0.11 J2	0.10	0.091	0.10	0.27	0.28
Basin M	5/3/2007	66	0.017 J J3	0.016 J J3	0.0054 J J3	0.0063 J J3	0.027	0.022 J3	0.02 J3	0.022 J3	0.0083 J J3	0.0097 J J3	0.014 J J3	0.014 J J3	0.095	0.12	0.066	0.067	0.18	0.27
Basin M	9/28/2007	39	0.02 J3	--	0.0075 J	--	0.0066 J	--	0.024	--	--	--	0.013 J	--	0.085	--	0.059	--	0.19	--
Basin M	10/23/2010	4	0.010 J	0.012 J R	<0.012	<0.012 R	0.033	0.024 R	0.017	0.016 R	--	--	0.011 J	0.0046 J R	0.031	0.010 J R	0.16	0.18 R	0.096	0.024 R
Basin M	11/6/2010	<1	0.016 J3	0.018 J3 R	0.013 J	0.014 R	0.044	0.032 R	0.014 J	0.0085 J R	--	--	0.0080 J	0.0047 J R	0.049	0.023 R	0.15	0.14 R	0.14	0.066 R
Basin M	2/12/2011	9	0.057 J3	0.015 J3 R	0.066	<0.012 R	0.1	0.031 R	0.093	0.018 R	--	--	0.077	0.016 J3 R	0.27	0.047 J3R	0.21	0.074 R	0.80	0.17 R
Basin M	11/11/2012	13.5	0.031 J3	--	0.0071 J3	--	0.032	--	0.011 J3	--	0.0064 J3	--	0.0089	--	0.033	--	0.07	--	0.092	--
Basin M	2/22/2013	75.5	0.013	--	0.0072	--	0.047	--	0.016	--	0.008	--	0.014	--	0.082	--	0.074	--	0.22	--
Applicable JSCS Screening Level Value		NA	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	NA	NA	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Please refer to notes at end of table.

Table 3
Storm Water Analytical Results: Polycyclic Aromatic Hydrocarbons
Terminal 4
Portland, Oregon

Monitoring Location	Date Sampled	TSS	Pyrene		Benz(a)anthracene		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenz(a,h)anthracene		Benzo(g,h,i)perylene	
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
		(mg/L)	Concentrations in µg/L (ppb)																	
Basin L	3/24/2007	108	2.7	0.08	1.6	0.048	2.5	0.087	3.4	0.11	1.2	0.04	2.2	0.05	2.7	0.063	0.54	0.014 J	2.5	0.069
Basin L	5/3/2007	207	2.4	1.6	1.3	0.80	1.7	1.1	3.0	2.0	0.98	0.65	2.0 J6	1.3 J6	2.5	1.7	0.56	0.36	2.5	1.7
Basin L	5/20/2007	309	3.9	1.1	2.7	0.58	3.8	1.1	5.5	1.4	1.9	0.5	3.7	0.86	3.8	0.93	0.84	0.18	3.5	0.91
Basin L	9/28/2007	80	1.0	--	0.57	--	1.0	--	1.5	--	0.44	--	0.87	--	0.97	--	0.21	--	0.87	--
Basin L	10/23/2010	7	0.51	0.03 R	0.18	0.012 J R	0.56	0.035 R	0.64	0.034 R	0.42	0.022 R	0.36	0.013 J R	0.37	0.023 R	0.13	0.0086 J R	0.47	0.044 R
Basin L	11/6/2010	28	0.18	0.029 R	0.051	0.0097 J R	0.19	0.027 R	0.19	0.026 R	0.13	0.014 R	0.079	0.010 J R	0.098	0.013 J R	0.034	0.0028 J R	0.13	0.021 R
Basin L	2/12/2011	10	0.36	0.015 J3 R	0.12	0.0032 J R	0.36	0.015 R	0.34	0.016R	0.27	0.0072 J R	0.21	<0.00066 R	0.2	0.0095 J R	0.061	0.0042 J R	0.25	0.012 J R
Basin L	11/17/2012	73.6	0.65	--	0.38	--	0.63	--	0.82	--	0.28	--	0.6	--	0.6	--	0.13	--	0.47	--
Basin L	2/22/2013	114	1.5	--	0.81	--	1.3	--	1.7	--	0.65	--	1.2	--	1.3	--	0.3	--	1.2	--
Basin M	3/24/2007	117	1.2	0.41	0.5	0.2	0.46	0.17	0.57	0.25	0.18	0.079	0.36	0.15	0.30	0.12	0.068	0.024	0.32	0.12
Basin M	4/7/2007	35	0.25	0.25	0.15	0.17	0.13	0.13	0.28	0.39	0.092	0.12	0.19	0.27	0.18	0.31	0.038	0.061	0.20	0.33
Basin M	5/3/2007	66	0.16	0.25	0.096	0.14	0.091	0.15	0.20	0.30	0.066	0.10	0.15 J6	0.23 J6	0.19	0.26	0.041	0.058	0.23	0.29
Basin M	9/28/2007	39	0.14	--	0.062	--	0.077	--	0.12	--	0.037	--	0.072	--	0.08	--	0.018 J	--	0.071	--
Basin M	10/23/2010	4	0.10	0.021 R	0.056	0.022 R	0.11	0.034 R	0.17	0.057 R	0.13	0.043 R	0.15	0.066 R	0.16	0.051 R	0.085	0.025 R	0.26	0.098 R
Basin M	11/6/2010	<1	0.16	0.073 R	0.087	0.042 R	0.26	0.10 R	0.47	0.17 R	0.28	0.090 R	0.41	0.12 R	0.27	0.084 R	0.13	0.038 R	0.42	0.15 R
Basin M	2/12/2011	9	0.71	0.15 R	0.45	0.11R	0.63	0.14 R	0.72	0.17R	0.58	0.12 R	0.61	0.14 R	0.36	0.076 R	0.15	0.027R	0.45	0.097 R
Basin M	11/11/2012	13.5	0.094	--	0.066	--	0.074	--	0.17	--	0.052	--	0.12	--	0.13	--	0.033	--	0.14	--
Basin M	2/22/2013	75.5	0.24	--	0.15	--	0.24	--	0.37	--	0.12	--	0.26	--	0.30	--	0.064	--	0.26	--
Applicable JSCS Screening Level Value		NA	0.2	0.2	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.2	0.2

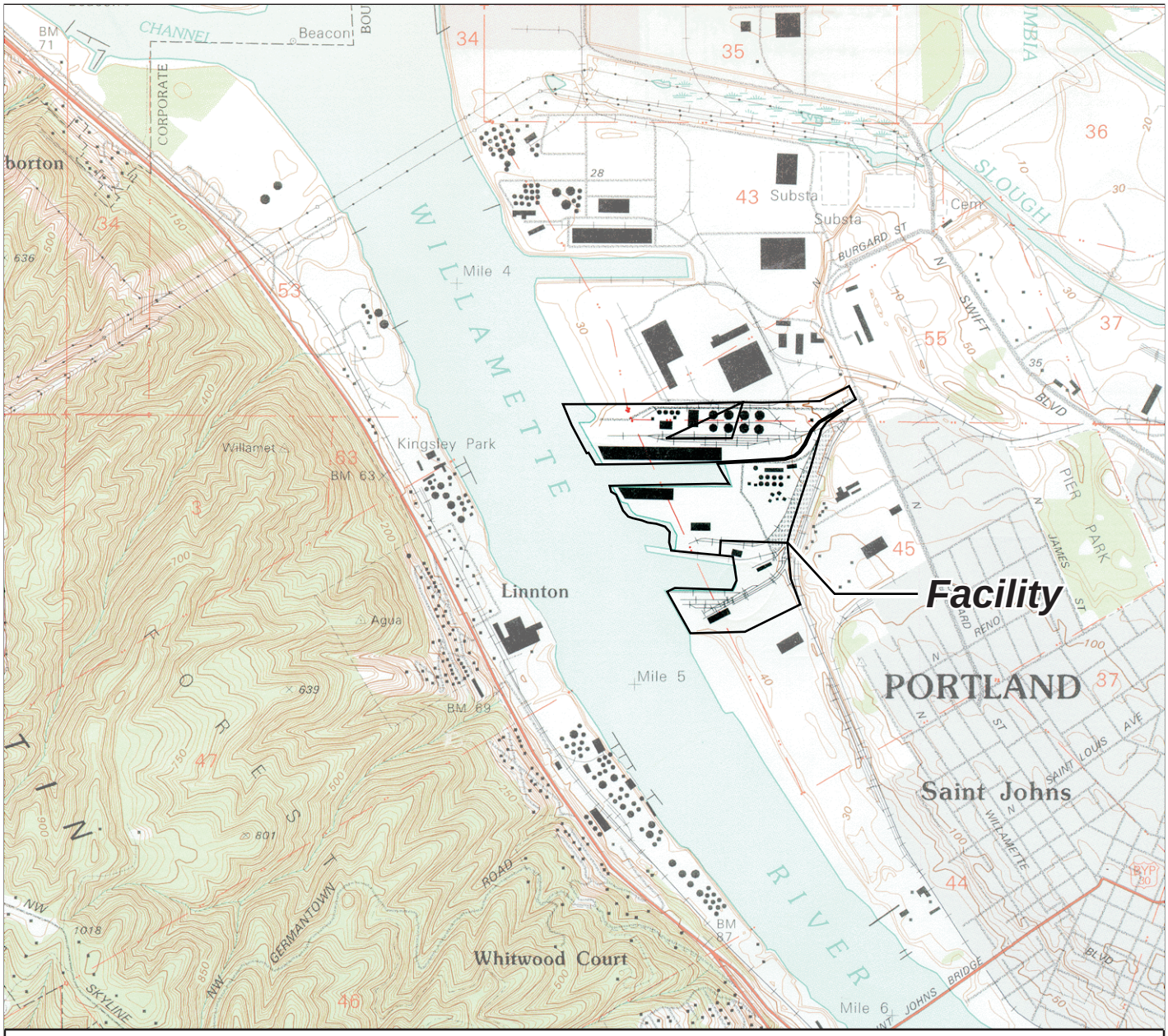
Notes:
1. Polynuclear Aromatic Hydrocarbons by EPA Method 8270 C SIM.
2. µg/L (ppb) = Micrograms per liter (parts per billion).
3. Screening levels used taken from Portland Harbor Joint Source Control Strategy Table 3-1: Screening Level values for Soil/Stormwater Sediment, Stormwater, Groundwater, and Surface Water (7/16/07 Revision).
4. **Bolded** values indicates concentration exceeds applicable screening level value.
5. J = The result is an estimated concentration that is below the Method Reporting Limit (MRL) and above the Method Detection Limit (MDL).
6. J2 = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. The precision goal of 30% was exceeded for this analyte by the results of the field duplicate sample or the lab duplicate.
7. J3 = The detected concentration of this analyte is equal to or less than 5 times the concentration detected in the method blank.
8. J6 = The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery for this analyte exceeded the control criteria.
9. R = The data are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria.
10. Shading indicates that the data have been rejected.
11. Filtration methods used for the dissolved analyses of samples collected on October 23, 2010 and November 6, 2010 were incorrect. The filter used was larger than specified in LWG protocols and the dissolved concentrations are likely biased high.
12. mg/L = milligrams per liter
13. TSS = total suspended solids by by EPA Method 160.2 or SM 2540D.

Table 4
Storm Water Analytical Results: General Chemistry Parameters
Terminal 4
Portland, Oregon

Monitoring Location	Date Sampled	Dissolved Organic Carbon	Total Organic Carbon	TSS	Turbidity
		Concentrations in mg/L (ppm)			NTU
Basin L	3/24/2007	3.0	4.5	108	68.8 J1
Basin L	5/3/2007	24.3	19.5	207	97.5
Basin L	5/20/2007	18	22	309	120
Basin L	9/28/2007	13.5	14.3	80	78.0
Basin L	10/23/2010	--	--	7	--
Basin L	11/6/2010	--	--	28	--
Basin L	2/12/2011	--	--	10	--
Basin L	11/17/2012	--	--	73.6	--
Basin L	2/22/2013	--	--	114	--
Basin M	3/24/2007	4.7	4.8	117	263 J1
Basin M	4/7/2007	9.7	11.5	35	61 J1
Basin M	5/3/2007	16.6	18.3	66	53.4
Basin M	9/28/2007	13.0	13.8	39	46.2
Basin M	10/23/2010	--	--	4	--
Basin M	11/6/2010	--	--	<1	--
Basin M	2/12/2011	--	--	9	--
Basin M	11/11/2012	--	--	13.5	--
Basin M	2/22/2013	--	--	75.5	--

Notes:

1. Dissolved and Total Organic Carbon by EPA method 415.1 or SM 5310 C.
2. Total Suspended Solids (TSS) by EPA Method 160.2 or SM 2540D.
3. Turbidity by EPA Method 180.1.
4. mg/L (ppm) = Milligrams per liter (parts per million).
5. NTU = Nephelometric Turbidity Units.
6. J1 = Hold time was exceeded for this analysis, the resulting value is estimated.



Base map prepared from the USGS 7.5-minute quadrangle of Linnton, Oregon, dated 1990.

N

0 2,000 4,000

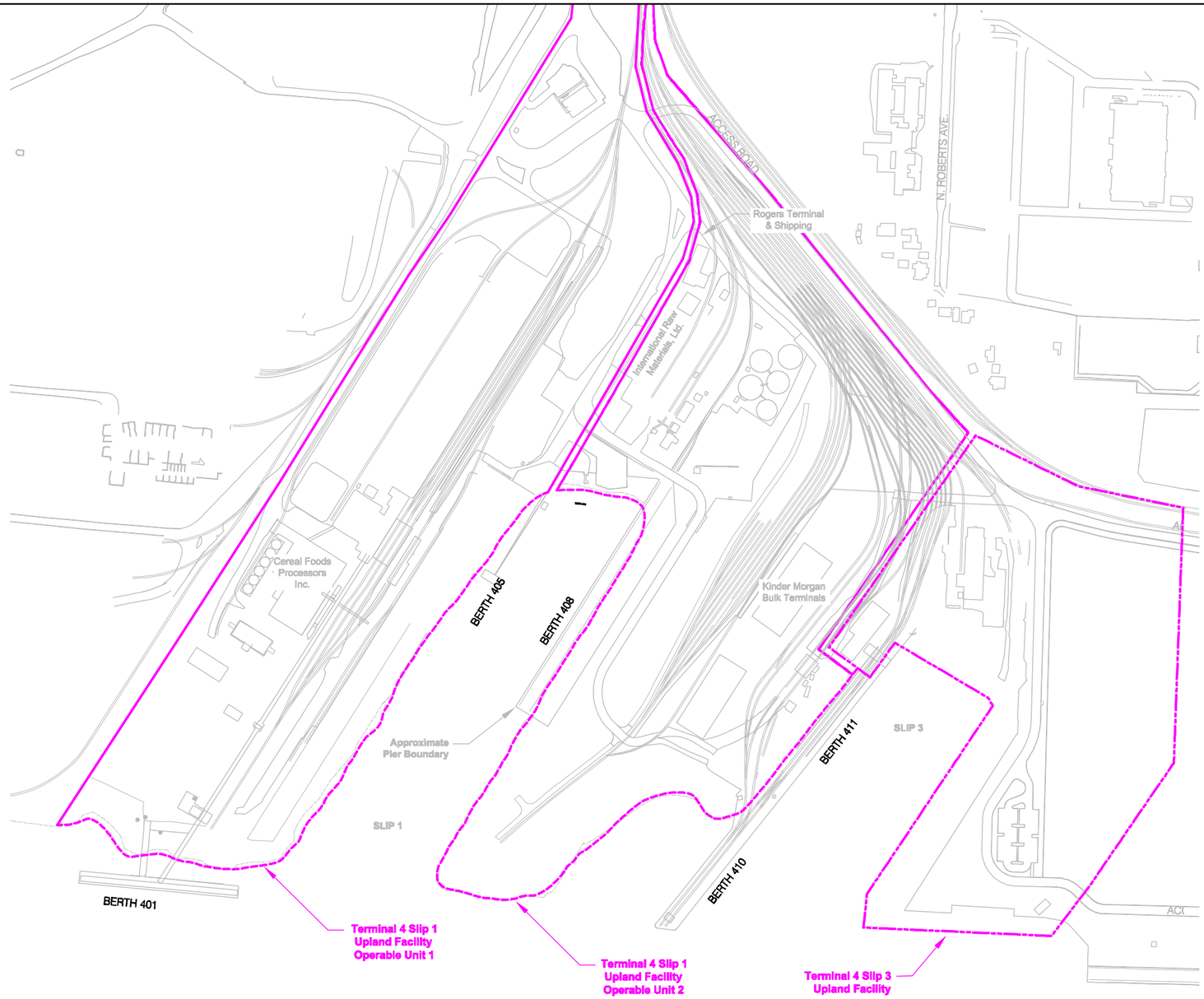
Approximate Scale in Feet

Facility Location Map

Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
April 2013		1



Legend:

- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

0 400 800

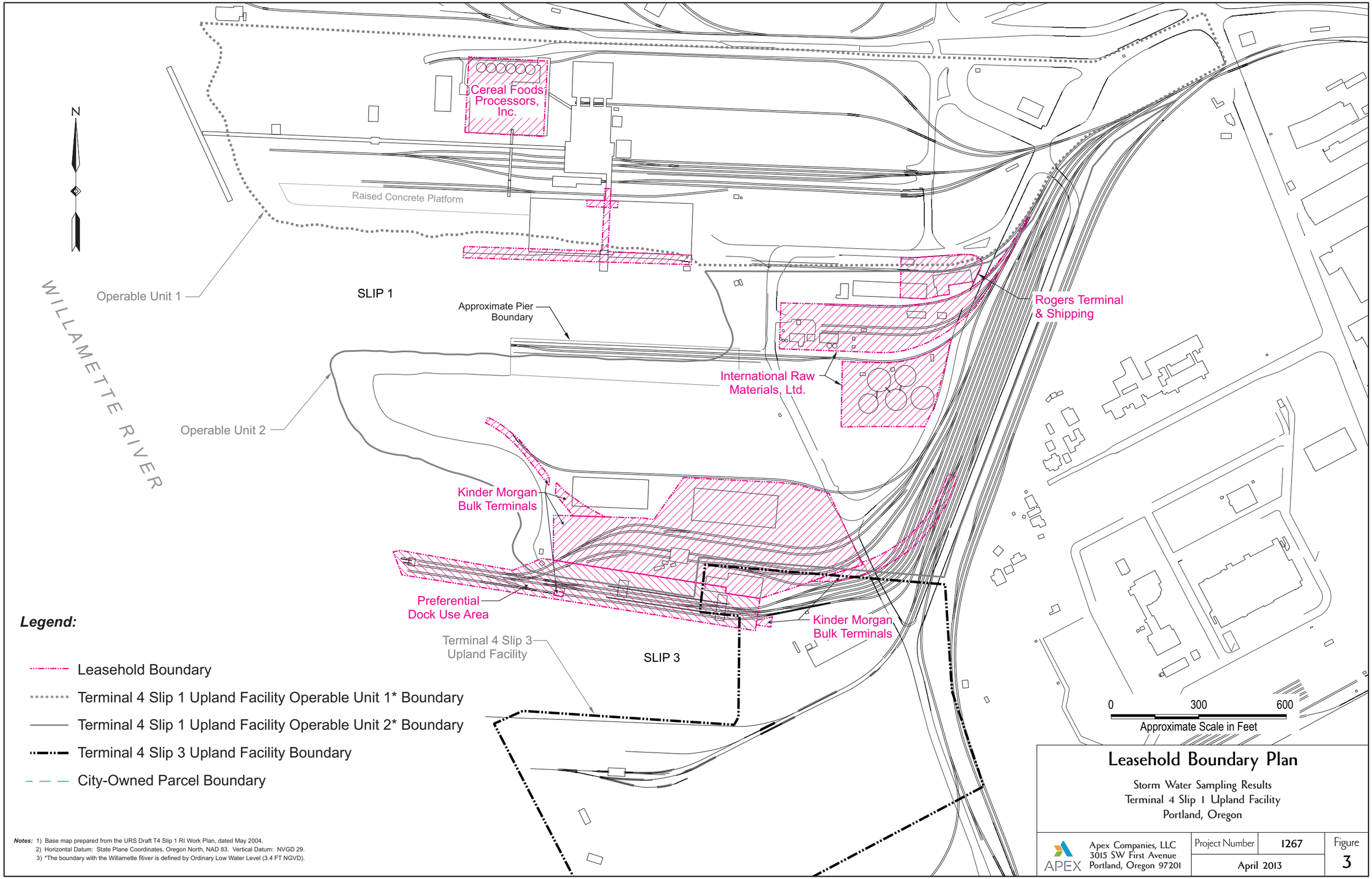
Scale in Feet

Facility Plan

Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
April 2013		2



Legend:

- Leasehold Boundary
- Terminal 4 Slip 1 Upland Facility Operable Unit 1* Boundary
- Terminal 4 Slip 1 Upland Facility Operable Unit 2* Boundary
- Terminal 4 Slip 3 Upland Facility Boundary
- City-Owned Parcel Boundary

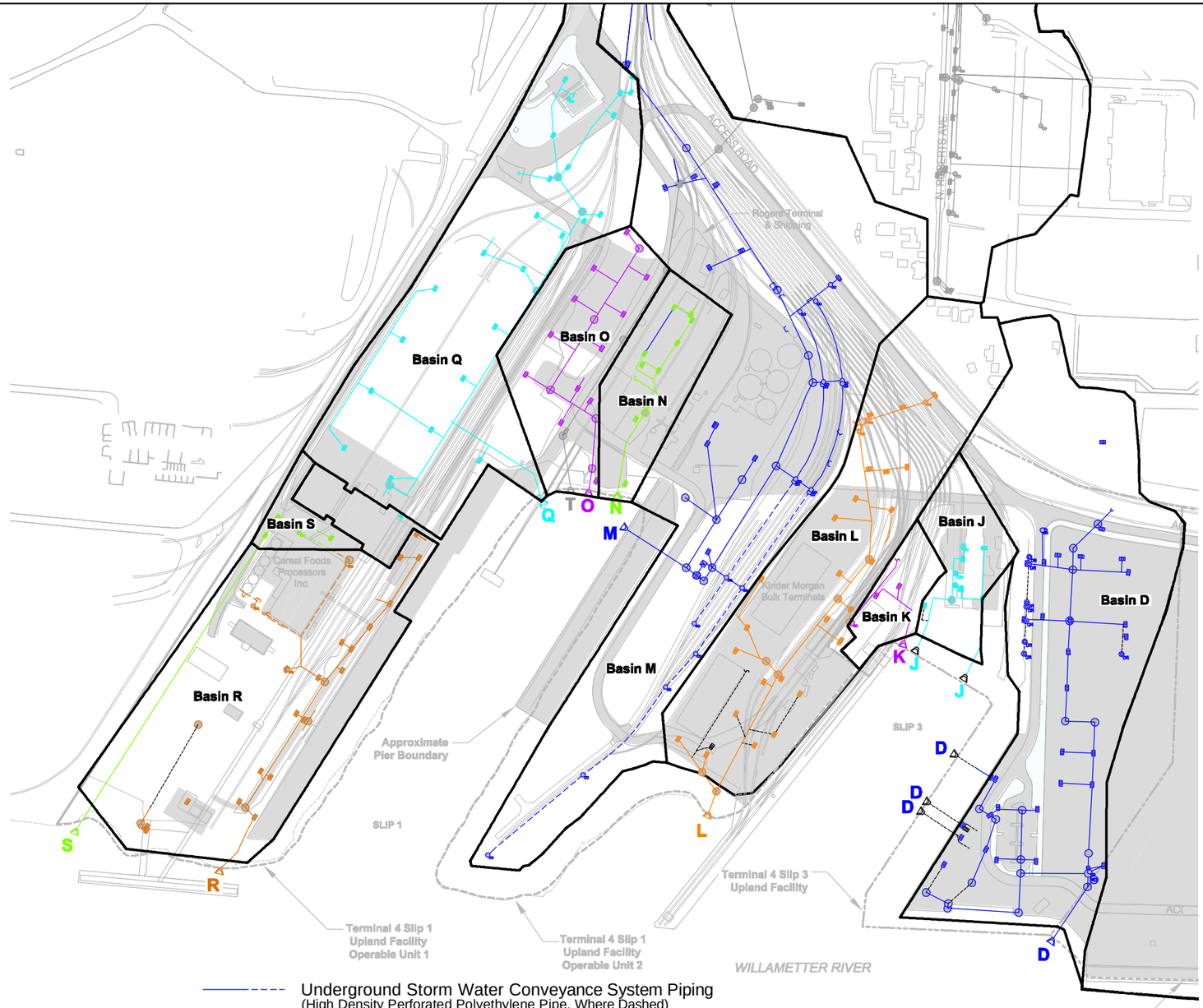
Notes: 1) Base map prepared from the URS Draft T4 Slip 1 RI Work Plan, dated May 2004.
2) Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3) *The boundary with the Willamette River is defined by Ordinary Low Water Level (3.4 FT NGVD).

Leasehold Boundary Plan

Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
April 2013		3



Legend:

- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Underground Storm Water Conveyance System Piping (High Density Perforated Polyethylene Pipe, Where Dashed)
- Unverified Underground Storm Water Conveyance System Piping
- Stormfilter Treatment Vault
- Oil Water Separator
- Catch Basin
- Water Quality Manhole (Downstream Defender)
- Cleanout
- Drain
- Manhole
- Manhole/Catch Basin
- D — Outfall with Basin Designation

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

0 400 800

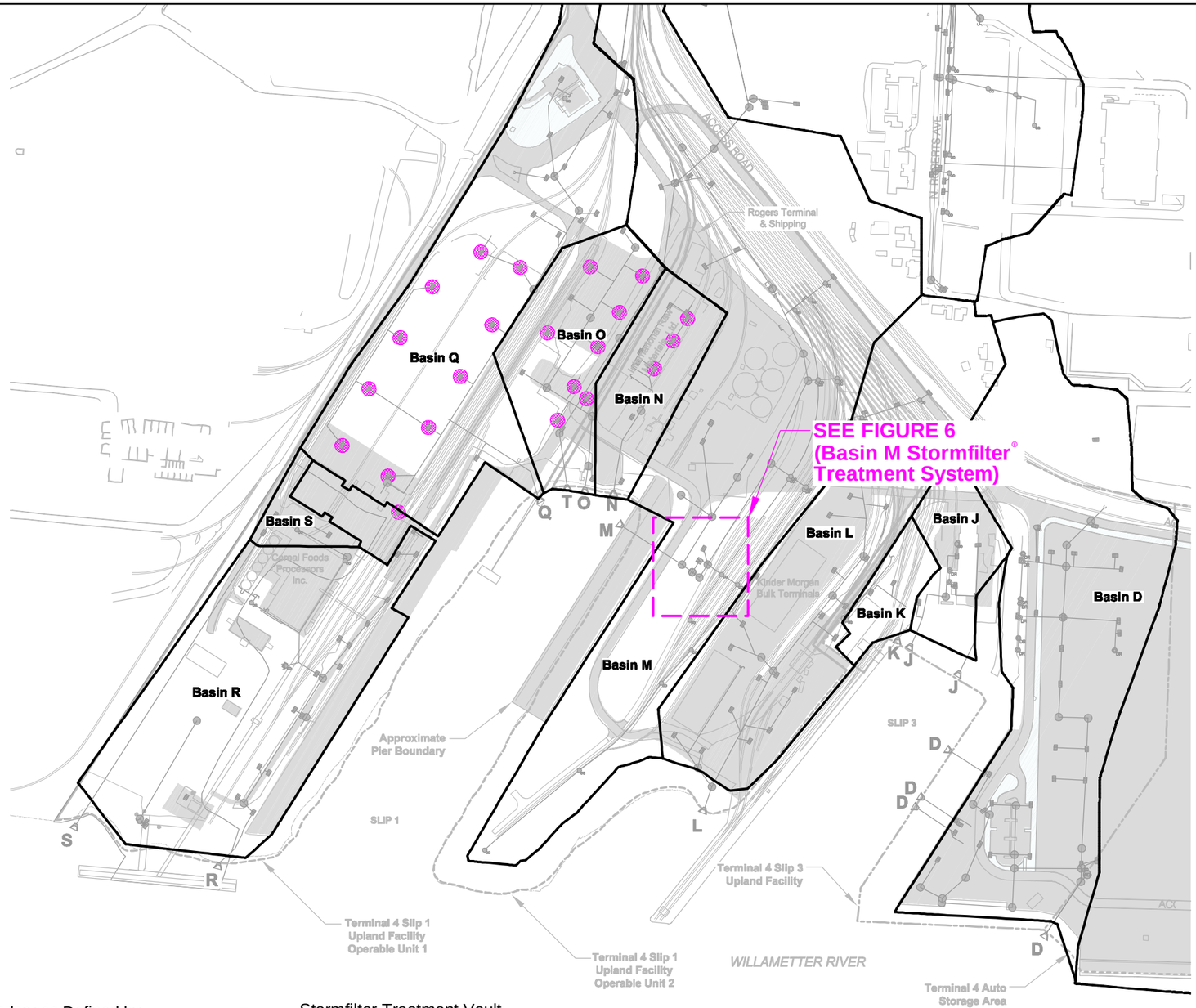
Scale in Feet

Storm Drain System and Drainage Basins

Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
April 2013		4



Legend:

- Catch Basins with Inserts
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Stormfilter Treatment Vault
- Underground Storm Water Conveyance System Piping
- Oil Water Separator
- Catch Basin
- Water Quality Manhole (Downstream Defender)
- Cleanout
- Drain
- Manhole
- Manhole/Catch Basin
- D — Outfall with Basin Designation

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

0 400 800

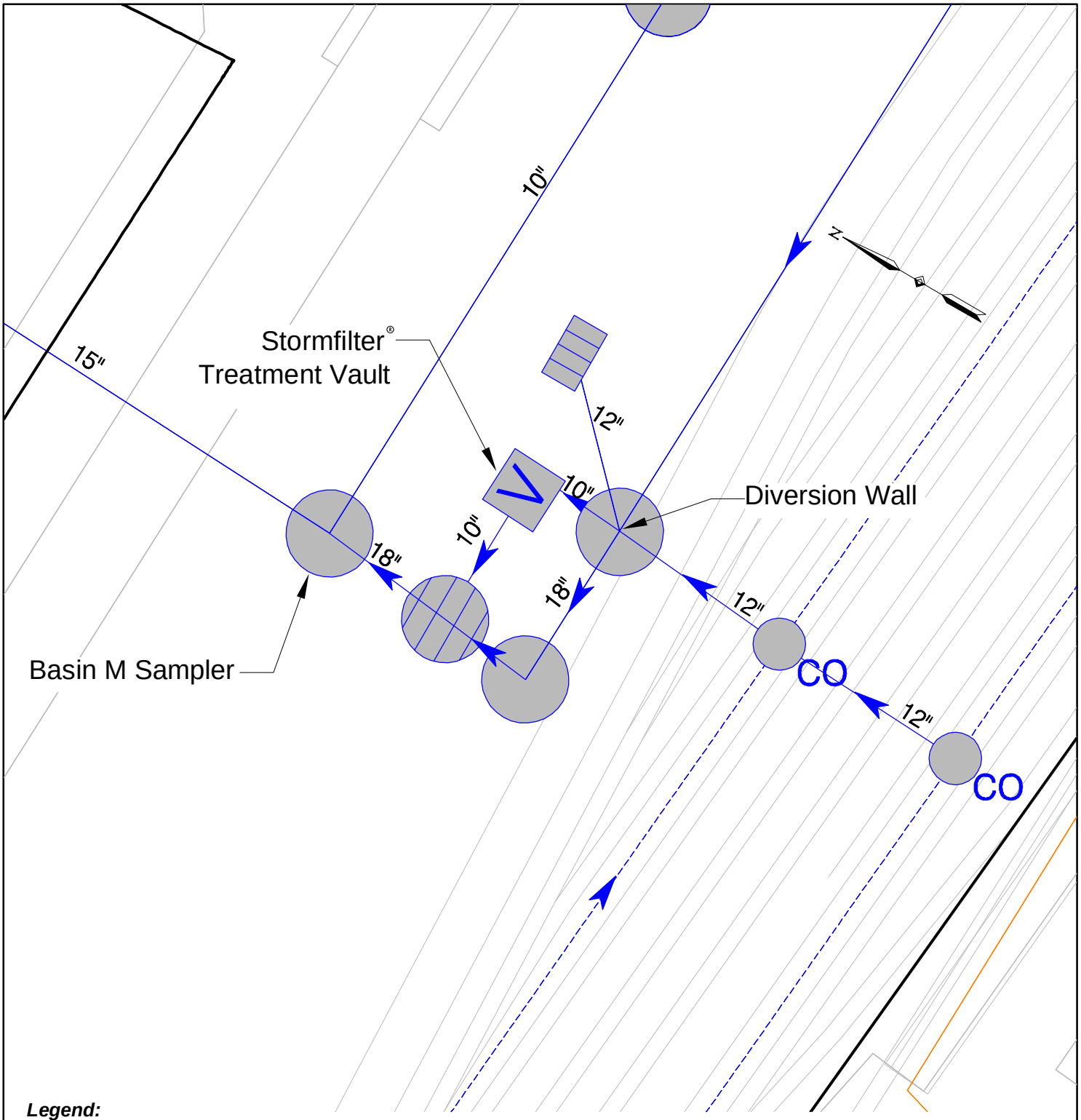
Scale in Feet

Storm Water Controls

Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
April 2013		5



Legend:

- Underground Storm Water Conveyance System Piping and Flow Direction
- V — Stormfilter Treatment Vault
- Catch Basin
- CO — Cleanout
- Manhole
- Manhole/Catch Basin

0 40 80

Scale in Feet

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.

Basin M Stormfilter® Treatment System

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1267	Figure
August 2012		6

Legend:

- Basin Q — Storm Water Sampling Manhole Location
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement

- Stormfilter Treatment Vault
- Underground Storm Water Conveyance System Piping
- Oil Water Separator
- Catch Basin
- Water Quality Manhole (Downstream Defender)
- Cleanout
- Drain
- Manhole
- Manhole/Catch Basin
- D — Outfall with Basin Designation

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

0 400 800

Scale in Feet

Proposed Storm Water Sampling Locations

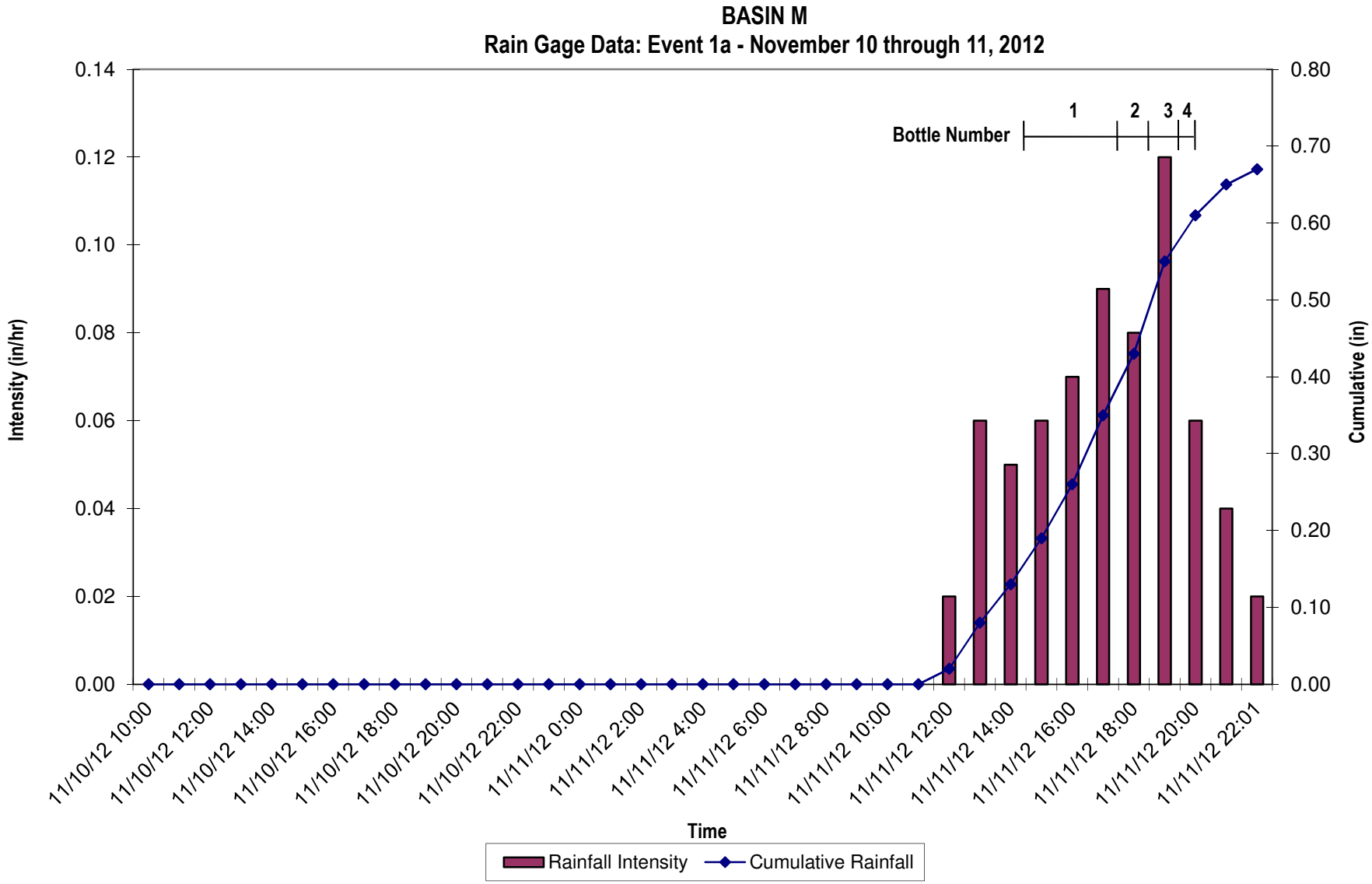
Storm Water Sampling Results
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

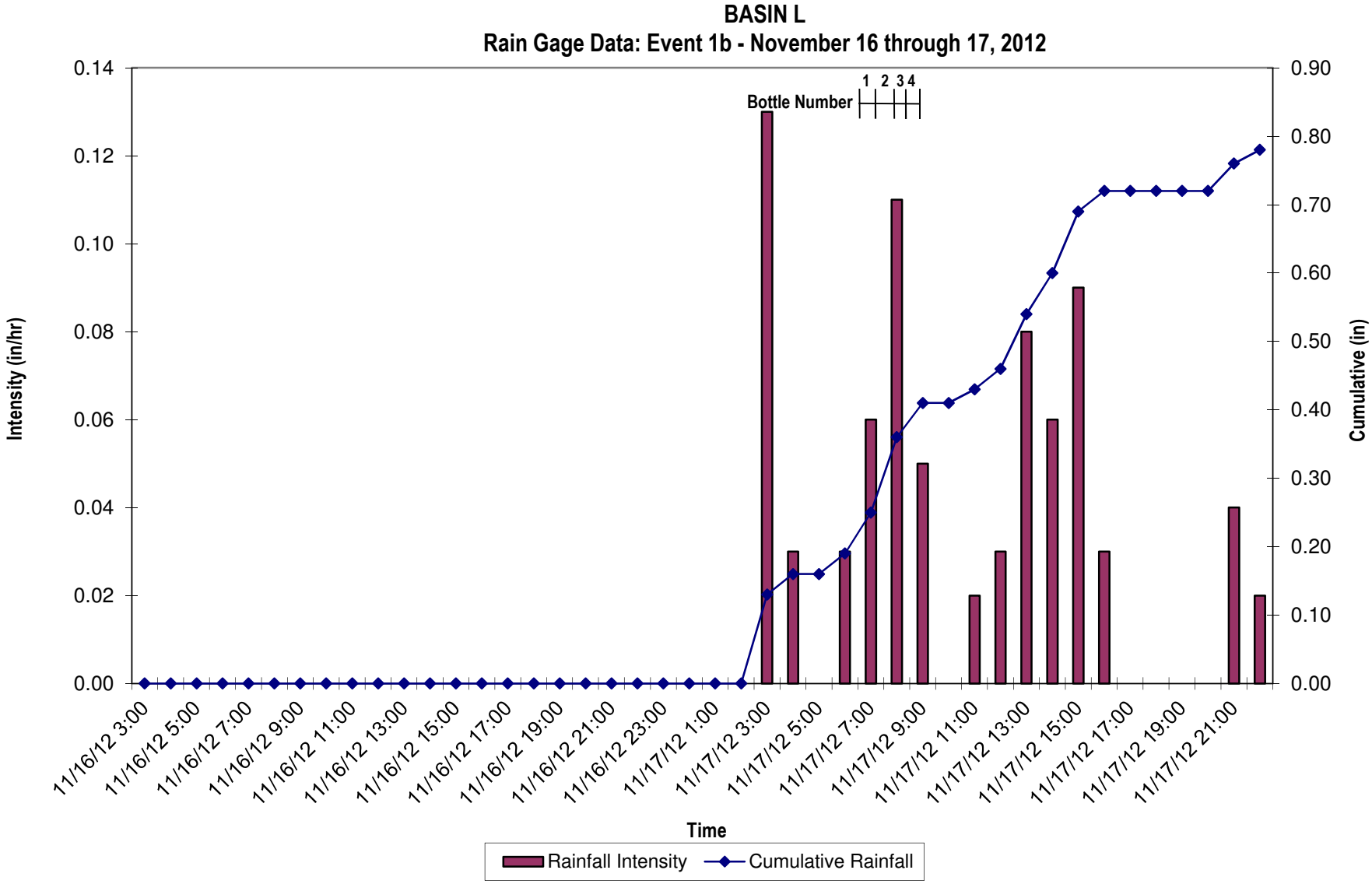
APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

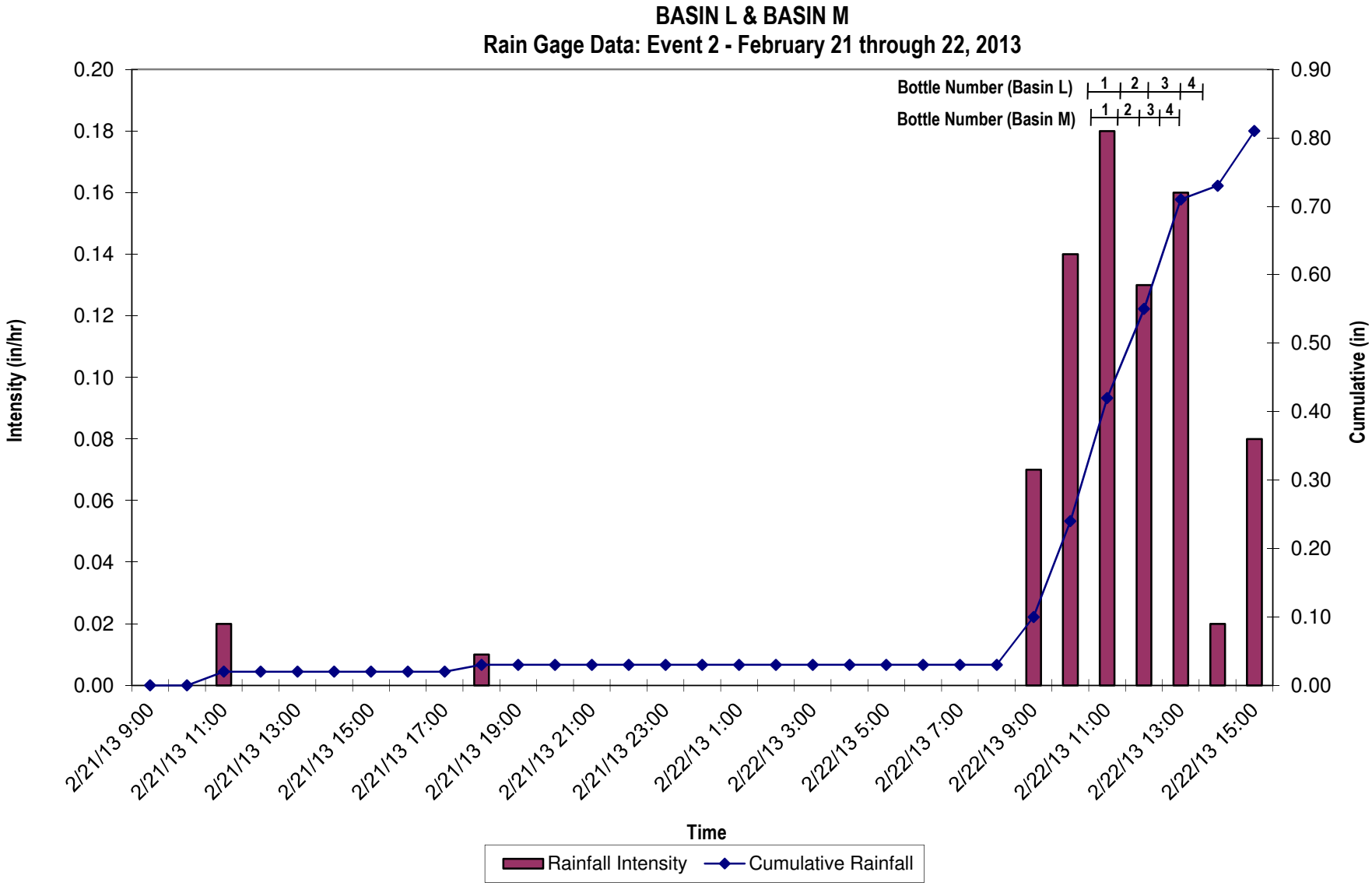
Project Number	1267	Figure
April 2013		7

Attachment A

Storm Water Hyetographs


BASIN M
Rain Gage Data: Event 1a - November 10 through 11, 2012
Intensity (in/hr)
Cumulative (in)
Bottle Number
1
2
3
4
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
11/10/12 10:00
11/10/12 12:00
11/10/12 14:00
11/10/12 16:00
11/10/12 18:00
11/10/12 20:00
11/10/12 22:00
11/11/12 0:00
11/11/12 2:00
11/11/12 4:00
11/11/12 6:00
11/11/12 8:00
11/11/12 10:00
11/11/12 12:00
11/11/12 14:00
11/11/12 16:00
11/11/12 18:00
11/11/12 20:00
11/11/12 22:01
Time
Rainfall Intensity
Cumulative Rainfall


BASIN L
Rain Gage Data: Event 1b - November 16 through 17, 2012
Bottle Number 1 2 3 4
Intensity (in/hr)
Cumulative (in)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
11/16/12 3:00
11/16/12 5:00
11/16/12 7:00
11/16/12 9:00
11/16/12 11:00
11/16/12 13:00
11/16/12 15:00
11/16/12 17:00
11/16/12 19:00
11/16/12 21:00
11/16/12 23:00
11/17/12 1:00
11/17/12 3:00
11/17/12 5:00
11/17/12 7:00
11/17/12 9:00
11/17/12 11:00
11/17/12 13:00
11/17/12 15:00
11/17/12 17:00
11/17/12 19:00
11/17/12 21:00
Time
Rainfall Intensity
Cumulative Rainfall


BASIN L & BASIN M
Rain Gage Data: Event 2 - February 21 through 22, 2013
Bottle Number (Basin L) 1 2 3 4
Bottle Number (Basin M) 1 2 3 4
Intensity (in/hr)
Cumulative (in)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
2/21/13 9:00
2/21/13 11:00
2/21/13 13:00
2/21/13 15:00
2/21/13 17:00
2/21/13 19:00
2/21/13 21:00
2/21/13 23:00
2/22/13 1:00
2/22/13 3:00
2/22/13 5:00
2/22/13 7:00
2/22/13 9:00
2/22/13 11:00
2/22/13 13:00
2/22/13 15:00
Time
Rainfall Intensity
Cumulative Rainfall

Attachment B

Laboratory Analytical Reports (CD-ROM) and Data Quality Review

Attachment B – Data Quality Review

1.0 Introduction

This appendix documents the results of a quality assurance (QA) review of the analytical data for storm water samples collected as part of the Terminal 4 Storm water Project. The data reviewed includes storm water sample data collected during sampling performed on November 12, 2012; November 17, 2012; and February 22, 2013. The samples were analyzed by ALS Environmental (ALS) of Kelso, Washington.

The QA review outlines the applicable quality control criteria utilized during the data review process, as well as any deviations from those criteria. Examination and validation of the laboratory summary report, includes:

- Analytical methods;
- Reporting limits;
- Detection limits and estimated concentrations;
- Sample holding times;
- Custody records and sample receipt;
- Spikes, blanks, and surrogates;
- Duplicates; and
- Calibration and internal standard.

The QA review did not include a review of raw data. Section 2.0 lists the analytical methods used in sample analysis. Section 3.0 defines the QA terms used in this report. Section 4.0 provides the QA results for each sampling event. Section 5.0 lists the qualifiers used in the tabulated results. A list of abbreviations used in this report is included at the end of the document for reference.

2.0 Analytical Methods

Chemical analyses on storm water samples consisted of one or more of the following, unless otherwise noted:

- Total Suspended Solids (TSS) by SM 2540D;
- Total metals (aluminum, antimony, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc) by EPA Method 200.8;
- Total arsenic by EPA Method 1632;
- Total mercury by EPA Method 7470A;

- Total polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270-SIM; and
- Total polychlorinated biphenyls (PCBs) as Aroclors by EPA Method 8082.

3.0 Quality Assurance Objectives and Review Procedures

The general QA objectives for this project were to develop and implement procedures for obtaining, evaluating, and confirming the usability of data of a specified quality for monitoring upland stormwater. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain-of-custody procedures.

Reporting limits and analytical results were compared to action levels for each parameter in the media of concern. Precision, accuracy, representativeness, completeness, and comparability parameters used to indicate data quality are defined below.

Reporting Limits. Method reporting limits (MRLs) are set by the laboratory and are based on instrumentation abilities, sample matrix, and suggested MRLs by the U.S. Environmental Protection Agency (EPA) or the Department of Environmental Quality (DEQ). In some cases, the MRLs are raised due to high concentrations of analytes in the samples or matrix interferences. MRLs are generally consistent with industry standards and below promulgated regulatory standards when possible (if not raised, as discussed above).

Detection Limits and Estimated Concentrations. The method detection limit (MDL) is the lowest quantity of a substance that can be distinguished from the absence of that substance within a stated confidence limit. The MDL is estimated from the mean of the blank, the standard deviation of the blank and some confidence factor.

Holding Times. Holding times are the length of time a sample can be stored after collection and prior to analysis without significantly affecting the analytical results. Holding times vary with the analyte, sample matrix, and analytical methodology used to quantify the analyte concentration.

Custody Records and Sample Receipt. Chain of custody (COC) refers to the document or paper trail showing the seizure, custody, control, transfer, analysis, and disposition of physical and electronic evidence. The sample receipt identifies the condition of samples upon arrival at the analytical laboratory. Samples with a specified temperature of 4°C shall be considered acceptable if the arrival temperature ranges from just above the freezing temperature of water to 6°C.

Method Blanks. A method, or laboratory, blank is a sample prepared in the laboratory along with the actual samples and analyzed for the same parameters at the same time. It is used to assess if detected contaminants may have been the result of contamination of the samples in the laboratory.

Laboratory Control Sample. A laboratory control sample (LCS) is analyzed by the laboratory to assess the accuracy of the analytical equipment. The sample is prepared from an analyte-free matrix that is then spiked with known levels of the constituents of interest (i.e., a standard). The concentrations are measured and the results compared to the known spiked levels. This comparison is expressed as percent recovery.

Laboratory Control Sample Duplicate. In addition, a second laboratory control sample (i.e., the laboratory control sample duplicate [LCSD]) is prepared as above and analyzed. This is compared to the initial laboratory control sample to assess the precision of the analytical method (i.e., relative percent difference [RPD]).

Matrix Spike Analyses. Matrix spike (MS) analyses are performed on samples submitted to the laboratory that are of the same matrix as the actual sample. It is spiked with known levels of the constituents of interest. These analyses are used to assess the potential for matrix interference with recovery or detection of the constituents of interest and the accuracy of the determination. The spiked sample results are compared to the expected result (i.e., sample concentration plus spike amount) and reported as percent recovery.

Lab Duplicate. A laboratory duplicate is a second analysis of the QA/QC sample, which serves as an internal check on laboratory quality as well as potential variability of the sample matrix. The laboratory duplicate is analyzed and compared to the primary sample analysis to assess the precision of the analytical method. This comparison can be expressed by the RPD between the original and duplicate sample.

Surrogate Recovery. Surrogates are organic compounds that are similar in chemical composition to the analytes of interest and spiked into environmental and batch QC samples prior to sample preparation and analysis. Surrogate recoveries for environmental samples are used to evaluate matrix interference on a sample specific basis.

Field Duplicate. A field duplicate is a second field sample collected from a selected sample point (i.e. groundwater monitoring well). Field duplicate samples serve as a check on laboratory quality as well as potential variability of the sample matrix. The field duplicate is analyzed and compared to the first sample to assess the precision of the analytical method. This comparison can be expressed by the RPD between the original and duplicate sample.

Calibration. Satisfactory instrument calibration is established to confirm that an instrument is capable of producing acceptable quantitative data. An initial calibration verification (ICV) demonstrates that the

instrument is capable of acceptable performance at the beginning of an experimental sequence. Continuing calibration verifies (CCV) that the daily performance of the instrument is satisfactory.

Internal Standard. An internal standard is a chemical substance that is added in a constant amount to samples, the blank and calibration standards in a chemical analysis. This substance is then used for calibration by plotting the ratio of the analyte signal to the internal standard signal as a function of the analyte concentration of the standards. This is done to correct loss of analyte during sample preparation.

4.0 QA/QC Review Results

The following subsections document the results of the quality assurance review for each sampling event.

4.1 November 11, 2012 Event – Basin M

Reporting Limits. MRLs were reviewed and are acceptable for this project. MRLs for individual samples varied based on the magnitude of the chemical impact.

Detection Limits and Estimated Concentrations. Concentrations of several PAHs are considered estimates due to detections above the MDL in the method blank. These data are flagged with a "J3" qualifier because the reported concentrations are less than five times the detected concentration in the method blank.

Holding Times. Analyses were completed within specified hold times. The method blank KWG1213560-5 for PAHs contained low levels of naphthalene and phenanthrene above the MRL. Consequently, in accordance with the ALS standard operating procedure (SOP), the sample was re-extracted and re-analyzed. The sample was re-extracted and re-analyzed outside of the hold time. The method bank associated with the re-extracted data also showed similar contamination. The results of the original analysis were reported. No corrective action was required.

Custody Records and Sample Receipt. Samples were received below the required temperature of 4°C and consistent with the accompanying COC.

Method Blank. The method blank results are summarized in the following table:

Analysis	Analyte	Concentration
PAHs	Naphthalene	7.6 ng/L

	2-Methylnaphthalene	2.8 ng/L J
	Acenaphthylene	2.4 ng/L J
	Dibenzofuran	3.1 ng/L J
	Fluorene	0.87 ng/L J
	Phenanthrene	6.0 ng/L
	Anthracene	0.61 ng/L J
	Fluoranthene	1.1 ng/L J
	Pyrene	0.98 ng/L J
	Benz(a)anthracene	0.80 ng/L J
	Benzo(g,h,i)perylene	0.37 ng/L J
Metals (Total)	Aluminum	0.5 µg/L J
	Arsenic	0.009, 0.005, and 0.007 µg/L J

The reported concentrations were flagged "J3" when the detected concentration was less than or equal to five times the detected concentration in the method blank.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits for TSS, metals, mercury, PAHs, and PCB aroclors. There was no LCS analyzed for arsenic.

Laboratory Control Sample Duplicate. Percent recoveries of the LCSD were within control limits for PAHs and PCB aroclors. There was no LCSD analyzed for TSS, metals, arsenic, or mercury.

Matrix Spike Analyses. Percent recoveries of the MS/MSD were within control limits for arsenic and PAHs. Percent recoveries of the MS were within control limits for metals, however, there was no MSD run for these analytes, the LCS for these analytes was within control limits. There was no MS/MSD analyzed for

TSS, mercury, or PCB aroclors. An LCS or an LCS/LCSD was reported in lieu of the MS/MSD for these samples.

Lab Duplicate. The lab duplicates for TSS and metals were within quality control limits. There were no lab duplicates for arsenic, mercury, PAHs, or PCB Aroclors.

Surrogate Recovery. Surrogate recoveries were within quality control limits.

Field Duplicate. No field duplicate was analyzed.

Calibration. Benzo(a)pyrene and indeno(1,2,3-cd)pyrene were outside of control limits in the continuing calibration verification (CCV) of lab samples MS11\1120F029.D and MS11\1126F033.D. The laboratory indicated that "in accordance with the EPA Method 8270D, 80% or more of the analytes must have passed within 20% of the true value, the remaining analytes are allowed up to a 40% difference as per the ALS SOP. No corrective action was required".

Internal Standard. Internal Standards were within quality control limits:

4.2 November 17, 2012 Event – Basin L

Reporting Limits. MRLs were reviewed and are acceptable for this project. MRLs for individual samples varied based on the magnitude of the chemical impact.

Detection Limits and Estimated Concentrations. Several PAHs were detected below the MRL but above the MDL. None of the sample concentrations were less than five times the detected concentration in the method blank and consequently none of the data were flagged.

Holding Times. Analyses were completed within specified hold times. The method blank KWG1213824-3 for PAHs contained low levels of naphthalene and phenanthrene above the MRL, in accordance with the ALS standard operating procedure (SOP), the sample was re-extracted and re-analyzed. The sample was re-extracted and re-analyzed outside of the hold time. The results of the original analysis were reported. No corrective action was required.

Custody Records and Sample Receipt. The samples were received below the required temperature of 4°C and consistent with the accompanying COC.

Method Blanks. The results from the method blanks are summarized in the following table:

Analysis	Analyte	Concentration
Metals (Total)	Aluminum	0.2 µg/L J
	Arsenic	0.009, 0.005 and 0.007 µg/L J
PAHs	Naphthalene	4.8 ng/L
	2-Methylnaphthalene	1.7 ng/L J
	Acenaphthene	1.5 ng/L J
	Dibenzofuran	2.3 ng/L J
	Fluorene	0.57 ng/L J
	Phenanthrene	4.5 ng/L
	Fluoranthene	0.89 ng/L J
	Benzo(a)anthracene	0.54 ng/L J

None of the sample concentrations were less than five times the detected concentration in the method blank and consequently none of the data were flagged.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits for TSS, metals, mercury, PAHs, and PCB aroclors. There was no LCS analyzed for arsenic.

Laboratory Control Sample Duplicate. Percent recoveries of the LCSD were within control limits for PAHs and PCB aroclors. There was no LCSD analyzed for TSS, metals, arsenic, or mercury.

Matrix Spike Analyses. Percent recoveries of the MS/MSD were within control limits for arsenic. Percent recoveries of the MS were within control limits for metals (with the exceptions below) and mercury. There was no MS/MSD analyzed for TSS, or PCB aroclors. An LCS or an LCS/LCSD was reported in lieu of the MS/MSD for these samples.

- Metals: The control criteria for MS recovery of aluminum and zinc were not applicable. The laboratory indicated that "the detected concentration in the sample was significantly higher than the added spike concentration, thereby preventing accurate evaluation of the spike recovery".

Lab Duplicate. The lab duplicates for TSS, metals, and mercury were within quality control limits. There were no lab duplicates for arsenic, PAHs, or PCB Aroclors.

Surrogate Recovery. Surrogate recoveries were within quality control limits, with the exception of PAHs. Two of the three surrogates were outside control limits. The low recovery may indicate a low bias. The data were accepted based on the remaining surrogate and the batch LCS and LCSD.

Field Duplicate. No field duplicate was analyzed.

Calibration.

- PAHs: Indeno(1,2,3-cd)pyrene was outside of control limits in the CCV of lab samples MS11\1204F015.D and MS11\1205F002.D. Benzo(a)pyrene, and indeno(1,2,3-cd)pyrene were outside of control limits in the CCV of lab sample MS11\1206F030.D. The laboratory indicated that "in accordance with the EPA Method 8270D, 80% or more of the analytes must have passed within 20% of the true value, the remaining analytes are allowed up to a 40% difference as per the ALS SOP. No corrective action was required".

Internal Standard. Internal standards were within quality control limits.

Other Narrative. The laboratory indicated the following with regard to the interpretation of the PCB Aroclors reported.

- "Three Aroclors were identified in sample Basin L: Aroclor 1242, Aroclor 1254, and Aroclor 1260. When mixtures of PCB Aroclors are present in a sample, correct identification and quantitative analysis of the individual Aroclors can be subjective. In particular, when mixtures are present, differentiating Aroclor 1242 from Aroclor 1248 can be difficult."
- "A review of the sample chromatogram indicated the presence of PCB patterns that spanned the entire elution range from Aroclor 1242 through the end of Aroclor 1260. Based on individual PCB peaks in the early portion of the chromatogram, Aroclor 1242 was identified and quantitated. Although the presence of Aroclor 1248 could not be ruled out, Aroclor 1242 appeared to be the best match based on the early eluting peaks in the PCB chromatogram. Aroclor 1260 was identified based on the presence of late eluting PCB peaks in the chromatogram. The remainder of the PCB pattern was identified as Aroclor 1254 because PCB peak height in the middle of the chromatogram was larger than could be attributed to Aroclor 1242, Aroclor 1248, or Aroclor 1260. When Aroclor mixtures are present in a sample, care is taken to minimize the possibility of double-counting PCBs. Analytical peaks are selected based on the best resolution possible for that particular sample. However, when a mixture of Aroclors 1242, 1254, and 1260 is present in a sample, the potential exists for a high bias from contribution of one Aroclor to another due to common peaks or peaks that cannot be completely resolved."

4.3 February 22, 2013 Event – Basin L and Basin M

Reporting Limits. MRLs were reviewed and are acceptable for this project. MRLs for individual samples varied based on the magnitude of the chemical impact.

Holding Times. Analyses were completed within specified hold times.

Detection Limits and Estimated Concentrations. The MDLs for aroclors 1016, 1221, 1232, 1242, and 1248 were elevated in the sample from Basin M due to matrix interference. The laboratory indicated that "the matrix interference prevented adequate resolution of the target compounds at the MDL".

Custody Records and Sample Receipt. The samples were received below the required temperature of 4°C and consistent with the accompanying COC.

Method Blanks. The results from the method blanks are summarized in the following table:

Analysis	Analyte	Concentration
Metals (Dissolved)	Antimony	0.012 µg/L J
PAHs	Naphthalene	1.4 ng/L J
	2-Methylnaphthalene	0.84 ng/L J
	Acenaphthene	0.51 ng/L J
	Dibenzofuran	1.0 ng/L J
	Phenanthrene	3.2 ng/L J
	Fluoranthene	1.0 ng/L J
	Pyrene	1.0 ng/L J
	Benzo(a)anthracene	1.1 ng/L J
	Chrysene	0.65 ng/L J
	Benzo(b)fluoranthene	0.69 ng/L J
	Benzo(k)fluoranthene	0.73 ng/L J
	Benzo(a)pyrene	0.56 ng/L J
	Indeno(1,2,3-cd)pyrene	1.1 ng/L J
	Dibenz(a,h)anthracene	0.96 ng/L J
	Benzo(g,h,i)perylene	0.95 ng/L J

None of the sample concentrations were less than five times the detected concentration in the method blank and consequently none of the data were flagged.

Laboratory Control Sample. Percent recoveries of the LCS were within control limits for TSS, PAHs, and PCB aroclors. There was no LCS analyzed for metals, mercury, or arsenic.

Laboratory Control Sample Duplicate. Percent recoveries of the LCSD were within control limits for TSS and PAHs. There was no LCSD analyzed for metals, arsenic, mercury, or PCB aroclors.

Matrix Spike Analyses. Percent recoveries of the MS/MSD were within control limits for arsenic, PAHs, and PCB aroclors. Percent recoveries of the MS were within control limits for metals (with the exceptions below) and mercury, however, there was no MSD run for these analytes. There was no MS/MSD analyzed for TSS.

- Metals: The control criteria for MS recovery of aluminum, copper, and zinc for the Batch QC1 sample were not applicable. The laboratory indicated that "the detected concentration in the sample was significantly higher than the added spike concentration, thereby preventing accurate measurement of the spike recovery". The sample selected by the laboratory for Batch QC1 was not from the Terminal 4 Stormwater sampling event.

Lab Duplicate. The lab duplicates for TSS and mercury were within quality control limits. There were no lab duplicates for metals, arsenic, PAHs, or PCB Aroclors.

Surrogate Recovery. Surrogate recoveries were within quality control limits, with the exception of PAHs. One of the three surrogates was outside control limits. The data were accepted based on the remaining surrogates and the batch LCS and LCSD.

Field Duplicate. No field duplicate was analyzed.

Calibration. Calibration standards were within quality control limits.

Internal Standard. Internal standards were within quality control limits.

Other Narrative. The laboratory indicated the following with regard to the interpretation of the PCB Aroclors reported.

- "Three Aroclors were identified in sample Basin L: Aroclor 1242, Aroclor 1254, and Aroclor 1260. When mixtures of PCB Aroclors are present in a sample, correct identification and quantitative analysis of the individual Aroclors can be subjective. In particular, when mixtures are present, differentiating Aroclor 1242 from Aroclor 1248 can be difficult.
- "A review of the sample chromatogram indicated the presence of PCB patterns that spanned the entire elution range from Aroclor 1242 through the end of Aroclor 1260. Based on individual PCB peaks in the early portion of the chromatogram, Aroclor 1242 was identified and quantitated. Although the presence of Aroclor 1248 could not be ruled out, Aroclor 1242 appeared to be the best match based on the early eluting peaks in the PCB chromatogram. Aroclor 1260 was identified based on the presence of late eluting PCB peaks in the chromatogram. The remainder of the PCB pattern was identified as Aroclor 1254 because PCB peak height in the middle of the chromatogram was larger than could be attributed to Aroclor 1242, Aroclor 1248, or Aroclor 1260. Also, two Aroclors were identified in sample Basin M: Aroclor 1254 and Aroclor 1260. When Aroclor mixtures are present in a sample, care is taken to minimize the possibility of double-counting PCBs. Analytical peaks are selected based on the best resolution possible for that

particular sample. However, when a mixture of Aroclors 1242, 1254, and/or 1260 is present in a sample, the potential exists for a high bias from contribution of one Aroclor to another due to common peaks or peaks that cannot be completely resolved".